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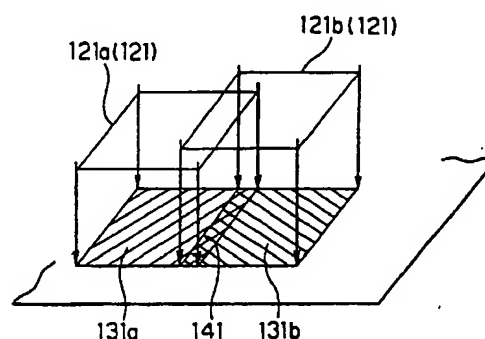
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## (54) Method of forming polycrystalline silicon layer and surface treatment apparatus therefor

(57) A method of forming a polycrystalline silicon thin film improved in crystallinity and a channel of a transistor superior in electrical characteristics by the use of such a polycrystalline silicon thin film. An amorphous silicon layer of a thickness preferably of 30 nm to 50 nm is formed on a substrate. Next, substrate heating is performed to set the amorphous silicon layer to preferably 350°C to 500°C, more preferably 350°C to 450°C. Then, at least the amorphous silicon layer is exposed to laser light of an excimer laser in an extent greater than approximately 10 cm<sup>2</sup> by single shot exposure. The energy density is 100 mJ/cm<sup>2</sup> to 500 mJ/cm<sup>2</sup>, preferably 280 mJ/cm<sup>2</sup> to 330 mJ/cm<sup>2</sup>. The pulse width is 80 ns to 200 ns, preferably 140 ns to 200 ns, so as to directly anneal the amorphous silicon layer and form a polycrystalline silicon thin film. The total energy of the laser used for the irradiation of excimer laser light is at least 5J, preferably at least 10J.

A surface treatment laser apparatus and different surface treatments e.g. oxidation or nitridation are also described.

FIG. 1





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# EUROPEAN SEARCH REPORT

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y	EP-A-0 373 055 (COMMISSARIAT À L'ÉNERGIE ATOMIQUE)	11,13,	H01L21/20 B23K26/06
A	* the whole document *	17,23,27 19,25,28	
Y	US-A-4 970 546 (NIKON CORPORATION)	11,13,	
A	* the whole document *	17,23,27 9,18,19, 21,22,24	
A	PATENT ABSTRACTS OF JAPAN vol. 17, no. 89 (E-1323), 22 February 1993 & JP-A-04 282869 (JII TEI SHII KK), 7 October 1992, * abstract *	1,7	
A	INTERNATIONAL ELECTRON DEVICES MEETING-WASHINGTON US, 8 - 11 December 1991, pages 563-566, XP002003298 H. KURIYAMA ET AL.: "high mobility poly-si tft by a new excimer laser annealing method for large area electronics" * page 564; figure 2 * * page 564, column 2, paragraph 2 *	1-3	TECHNICAL FIELDS SEARCHED (Int.Cl.6)
A	PATENT ABSTRACTS OF JAPAN vol. 17, no. 398 (E-1403), 26 July 1993 & JP-A-05 074704 (SEIKO EPSON CORP.), 26 March 1993, * abstract *	4	H01L B23K
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 17 May 1996	Examiner Aran, D
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... & : member of the same patent family, corresponding document	
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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	<p>EIGHTH E.C. PHOTOVOLTAIC SOLAR ENERGY CONFERENCE-FLORENCE IT, 9 - 13 May 1988, pages 1280-1284, XP002003299</p> <p>1. REIS ET AL.: "recrystallization of polycrystalline silicon layers by an optical heating technique"</p> <p>* abstract *</p> <p>-----</p>	1,7	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		17 May 1996	Aran, D
<p><b>CATEGORY OF CITED DOCUMENTS</b></p> <p>X : particularly relevant if taken alone  Y : particularly relevant if combined with another document of the same category  A : technological background  O : non-written disclosure  P : intermediate document</p> <p>T : theory or principle underlying the invention  E : earlier patent document, but published on, or after the filing date  D : document cited in the application  L : document cited for other reasons</p> <p>-----  &amp; : member of the same patent family, corresponding document</p>			